

# FOCUS NORTH 2-2007

## Fishing and Aquaculture

Produced by the research company Ocean Futures, Oslo for the Norwegian Atlantic Committee

### Norway – a global seafood producer

Norway is a fishing nation. Fishing has been a key industry along the coast for generations, and fishing still plays a major role in the Norwegian economy today.

In 2003, Norway and Russia were the world's tenth largest seafood producers, producing about 3.3 million tons each. In Norway, 2.7 million tons came from marine fisheries and 600,000 tons from fish farms. For comparison, the global seafood production was about 129.5 million tons in 2001, with 91.8 million tons from marine fisheries and 37.7 million tons from aquaculture.

Processed and unprocessed seafood products are Norway's third most important export after oil, gas and metals. Exporting 90 percent of the seafood it produces, Norway is the world's third largest seafood exporter, behind only China and Thailand. In 2004, Norwegian seafood exports totalled €3.4 billion, accounting for 5.1 percent of Norwegian export income.

Although structural changes in the Norwegian fishing sector have reduced the number of fishing vessels from 13,000 to 7,700 over the last six years, the seafood industry is more profitable than ever before. The sector remains an important source of employment; some 34,600 people were employed in seafood production in 2004. Of these, 17,000 were engaged in marine fishing, 4,600 in aquaculture, and 13,000 in fish processing. Many others are employed in selling goods and services to the seafood sector.

### Marine fisheries in the Barents Sea

The Barents Sea is a highly productive sea area. Although it contains some 150 fish species, it is a relatively simple ecosystem with few species of potentially high abundance. These are Northeast Arctic cod, capelin, saithe, haddock and Norwegian spring-spawning herring. These five species are particularly important in the commercial fisheries.

Cod, capelin and herring are key species. Cod is the most important predator, while capelin is the most important prey. Capelin feed on zooplankton near the ice edge. They migrate northwards as the ice retreats in summer, giving them continuous access to new zooplankton in the productive zone uncovered by the ice. Cod prefer capelin as a prey, and feed on them heavily as the capelin migrate south to spawn. Juvenile herring in turn feed on capelin larvae. Fluctuations in the capelin stock in turn have a strong effect on cod.

### Distribution and status of fish stocks

*Arctic cod* spawn in March–April near Lofoten. By August–September they are spread in a belt from Svalbard south-eastward towards Novaya Zemlya. In the 1980s the stock was severely overfished. After setting strict fishing limits, the stock made a quick recovery and now lies within safe biological limits.

*Capelin* are found largely along the ice-edge, and come in towards shore to spawn along the coast of Troms, Finnmark and the Kola Peninsula (the summer ice-edge is shown in Figure 1 by the dark green line in the northern part of the Barents Sea, and the winter ice-edge by the light green line to the south.). The capelin stock has collapsed and currently lies at an extremely low level.

*Saithe* are found along the coast and offshore banks from the Kola Peninsula of Russia down to the North Sea. They spawn in February between the North Sea and Lofoten. The stock is within safe biological limits.

*Haddock* spawn in deep water along the coast, particularly in the area north of Tromsø. Different year groups spread out in different directions. From having been at an extremely low level in the 1980s, the stock is now at a healthy level.

*Herring* spawn in February–April along the coast of western and northern Norway. In August–September they move in dense shoals in the western part of the Barents Sea, while in the course of

the winter they move eastward into the Russian zone. The herring stock is believed to be within safe biological limits. A breakdown in negotiations over herring quotas in 2005, however, has made it more difficult to regulate the fishery.

## Fishing activity in the Barents Sea

Figure 1 illustrates fishing activity in the Barents Sea. The following colours indicate the intensity of fishing vessel activity averaged over a whole year: ■ *red* represents an area of very high fishing activity, ■ *brown* is high, ■ *orange* is moderate, and ■ *yellow* is low. (Maps with full colour version are available at [www.dnak.org](http://www.dnak.org))

The total Norwegian catch in the Barents Sea for 2002 was 2.7 million tons, of which the five major stocks accounted for 1.3 million tons, or 48 percent. The total landed value was €1.4 billion.

## Regulating fishing in the Barents Sea

The Barents Sea fisheries are important to many countries. Excessive fishing by one party can cause serious consequences for the others. Overfishing is already a problem in many of the world's fisheries, as technological developments have produced extremely effective, efficient fishing fleets with a potential harvesting capacity that far exceeds the limits of sustainability.

To prevent overfishing, several coastal states, international institutions and agreements are involved in deciding *who, what, when, how* and *how much* one can fish in the Barents Sea. From being nearly unregulated 30 years ago, fishing in the Barents Sea is today highly regulated.

## Considerations for fisheries management

Four key considerations must be balanced in the development and regulation of fishing. The first is *sustainable harvest*, which means that one must not take more fish from a stock than it is able to replace. If this principle is followed, then the stock is a renewable resource.

The second is *economic benefit*, which implies the desire to maximize exploitation and profit.

The third is *continuity*. The seafood industry, workers, coastal communities and consumers all desire a continuous, stable supply of fish.

The fourth is *uncertainty*. We do not have perfect information on the size of fish stocks, natural fluctuations or ecosystem function. The degree of uncertainty influences the assumptions and calculations that fisheries managers make and the risks they take in managing the fisheries.

Figure 1 – Fishing activity and aquaculture production



### Setting the catch quota

The different areas and zones in the Barents Sea have different regulations and quota arrangements, such as the Norwegian exclusive economic zone, the fishery protection zone around Svalbard, and the Barents Sea Loophole (labelled as *Smutthullet* in Figure 1). The process for setting annual catch quotas, however, is roughly the same, and can be described as a four-step process:

- Step 1:* Basic research on species and ecosystems;
- Step 2:* Scientific estimates on the size of each fish stock and recommendations on Total Allowable Catch;
- Step 3:* Negotiations on Total Allowable Catch and national quotas; and
- Step 4:* Distribution of quotas by national authorities to their fishing fleets.

The scientifically recommended Total Allowable Catch (TAC) and the politically agreed TAC are often different. This is due to the fact that besides biological factors, there are economic, social and other political concerns which come into play when countries negotiate fishing quotas.

Each country's percentage share of the total quota is negotiated separately and is often set in advance for several years at a time. These shares are applied to the annually agreed TAC to determine how much fish each may take that year.

Table 1 summarizes the TAC and catch statistics for the five major fish stocks in the Barents Sea for 2002.

### Illegal and unreported fishing

Illegal and unreported fishing have long occurred in the Barents Sea. Norwegian authorities estimate that as much as 100,000 tons of fish are caught illegally each year. This represents a market value on the order of €190 million.

In addition to surveillance and enforcement, fisheries managers have sought to adjust fishing quotas to take illegal and unreported fishing into account to help prevent overfishing.

### Aquaculture

Aquaculture has been an important industry in Norway since the beginning of the 1970s. Norway was the world's seventh largest aquaculture nation in the last ranking by the United Nations Food and Agriculture Organization. Norway's production of farmed fish was about 600,000 tons in 2003.

Aquaculture in Norway is centred primarily upon salmon and trout. At the beginning of 2003, Norwegian fish farms contained 237 million fish, of which 84 percent were salmon and 13 percent trout. Other species are farmed as well, including cod, char, halibut, mussels, oysters and scallops, but these constitute a very small proportion of fish farming in Norway today. Research is underway to make them economically viable, and many believe that they will play a major role in the Norwegian aquaculture sector in the future.

### Aquaculture in northern Norway

Fish farming is a major industry in northern Norway. Nordland, one of the four northernmost counties, is the nation's largest producer of farmed fish, accounting for 19 percent of national production by value. Together, the four northernmost counties account for 45 percent of salmon production and 20 percent of trout production.

Figure 1 illustrates aquaculture production in the four northernmost counties. The circled number is the county's percentage contribution to national production by value. The hexagon shows which species it produces and their relative contribution to production, where each triangle in the hexagon represents approximately 4 percent of production by value. ► *blue* triangles = salmon; ► *orange* = trout; and ► *green* = other fish, molluscs and shellfish.

Table 1 – Barents Sea fisheries, 2002  
(amounts in 1000 tons)

Species	TAC		Actual catch			
	Advised	Agreed	Norway	Russia	Others	Total
Arctic cod	181	395	203	184	58	445
Capelin	< 650	650	398	228	17	643
Haddock	< 67	85	40	37	7	84
Herring	853	850	485	110	236	831
Saithe	< 152	162	144	5	5	154
<b>Total</b>		2142	1270	564	323	2157

### Economics

Norway exported €1.4 billion worth of seafood from farmed salmon and trout in 2003. This represents 43 percent of total seafood exports by value.

Nevertheless, the aquaculture industry has had difficulty showing a profit. The sector lost €163 million before taxes in 2003. The loss was largely due to poor market conditions, including a 3.9 percent fall in the average sales price for salmon.

In spite of the loss, there were also some positive economic developments in the industry. Productivity increased and the average production cost per kilo went down, albeit with some significant regional differences.

### **Aquaculture and the environment**

Aquaculture can cause adverse environmental effects. Several issues are of particular concern:

#### ***Escape to the wild***

One concern is that farmed salmon will escape their pens, intermingle with wild salmon and genetically contaminate them. As the production of farmed salmon is hundreds of times larger than the wild Atlantic salmon stock, even small releases percentage-wise could have significant effects. In 2002, an estimated 676,000 salmon and trout escaped Norwegian fish pens (about 0.3 percent of the total farm stock). Damage to fish pens by heavy weather is the chief cause of fish escape.

#### ***Disease and medication***

Diseases in farmed fish lower aquaculture productivity and profitability, as well as constitute a modest risk of infection to wild fish stocks. Antibiotics and other measures have helped reduce the rate of bacterial and viral infection in recent years; nevertheless, controlling disease remains a challenge.

Excessive use of antibiotics is also a concern. In response, the industry has reduced its use of antibiotics by 97 percent over the last ten years by introducing more effective vaccination procedures and better operational routines.

#### ***Salmon louse***

The salmon louse is a parasite which attaches to fish species such as salmon and trout. Infected fish suffer from reduced weight and quality. The salmon louse is an expensive problem, costing Norway's aquaculture industry €40–60 million each year. It is unknown how much damage is caused to wild fish stocks as a result of salmon lice among farmed fish.

#### ***Chemicals***

Nets used in fish pens are impregnated with copper oxide to prevent fouling by marine organisms.

Copper oxide is effective in preventing fouling, but it is also acutely poisonous to many marine organisms. Although reducing marine pollution from anti-foulants is a clear political goal, the use of copper oxide remains relatively stable due to the lack of a good alternative.

#### ***Organic material loads***

Fish farming adds large amounts of organic material and industrial salts to coastal waters as a result of fish feed and excrement. In Norway, the aquaculture industry is the largest contributor of phosphorous to coastal waters, while agriculture and aquaculture contribute about the same amount of nitrogen.

#### ***Fishing pressure on wild stocks***

Wild fish constitute a main ingredient in the feed used by fish farms. An increase in fish farming thus automatically means increased pressure on wild fish stocks, many of which are already overfished.

### **Management Plan for the Barents Sea**

In March 2006, the Norwegian government presented an Integrated Management Plan for the Barents Sea. The plan aims to establish a holistic, ecosystem-based management of activities. The plan affects the fishing and aquaculture industries as it relates to the overall goal of regional sustainability and ecosystem management of wild and farmed fish resources.

Moreover, the plan seeks to facilitate the coexistence of different industries—especially fishing and aquaculture, shipping, and petroleum—while ensuring an increase in activity levels does not place too great a pressure on the environment.

The plan introduces area-based management, where activities and measures are adjusted to an area's environmental characteristics. Several particularly valuable and vulnerable areas are identified; these encompass the key spawning and egg and larval drift areas for the key commercial fish stocks. Petroleum activity is limited or restricted in these areas.

*Summarized from "Fisheries and Aquaculture in the Northern Areas" (10/2005), available (in Norwegian) at [ocean-futures.com](http://ocean-futures.com)*

**Maps with full colour version are available at [www.dnak.org](http://www.dnak.org)**

## **About FOCUS NORTH**

This series of short fact sheets will cover current issues on developments in The High North. The first 10 issues are written by experts from Ocean Futures, [www.ocean-futures.com](http://www.ocean-futures.com) The series can also be downloaded from the web, [www.dnak.org](http://www.dnak.org)